

Industrial Maturity of FR Fuel Cycle Processes and Technologies

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Summary

- ▶ **Introduction**
- ▶ **Fuel Types**
- ▶ **Fuel Cycle**
- ▶ **Processes**
 - ◆ **Reprocessing**
 - ◆ **Manufacturing**
- ▶ **Conclusion**

- ▶ **History of Fast Reactors :**
- ▶ **18 Reactors in 9 countries**
- ▶ **Operation duration from 1 to 43 years**
- ▶ **Thermal power from 1.4 up to 3000 MW**
- ▶ **Total thermal output (estimated) : 130 GW.Yy**
- ▶ **Thermal output from metal fuel : 7.2 GW.y or 5.5 %**
- ▶ **Thermal output from oxide fuel : 122 GW.y or 93.7 %**

Fuel Types

▶ Metal

- ◆ Around 5.5% of total produced FR Fuel
- ◆ US, UK, Russia, Japan, China

▶ Oxide

- ◆ Around 93.7% of total produced FR Fuel
- ◆ US, France, Germany, Russia, Japan, UK, China, India

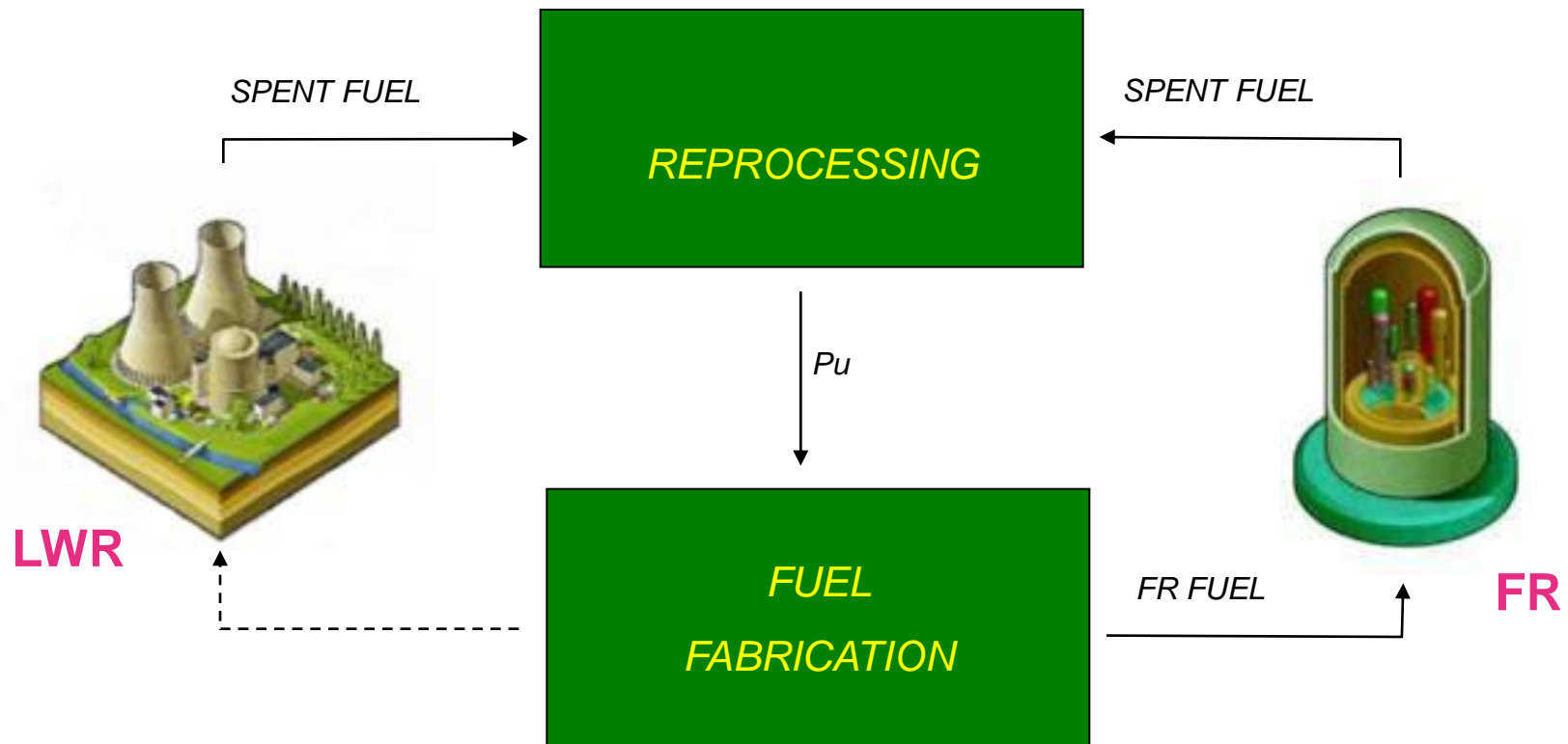
▶ Carbide

- ◆ Less than 1% of total produced FR Fuel
- ◆ India

▶ Nitride

- ◆ US, Russia, Japan

Fuel Cycle



Processes : Reprocessing

▶ Hydrometallurgy

- ◆ Fully mature industrially for LWR Fuel (> 30 000 tons)
- ◆ Industrially proven for FR Fuel (several tens of tons)
- ◆ Suitable for Oxide and Carbide
- ◆ Not suitable for Nitride and Metal

▶ Pyroprocessing

- ◆ Suitable for Metal, possibly for Oxide
- ◆ Lab or Pilot scale

Processes : Manufacturing

▶ Oxide : MOX

- ◆ Fully mature industrially for LWR Fuel (several thousands of tons)
- ◆ Industrially proven for FR Fuel (several tens of tons)

▶ Oxide : Vibropac

- ◆ Lab scale

▶ Metal : UPuZR

- ◆ Small industrial scale (a few tons)

Conclusion

- ▶ **FR fuel cycle processes and technologies have already been proven industrially for Oxide Fuel, and to a lesser extent for metal fuel.**
- ▶ **In addition, both used oxide fuel reprocessing and fresh oxide fuel manufacturing benefit from similar industrial experience currently deployed for LWR.**
- ▶ **Alternative fuel type will have to generate very significant benefit in reactor (safety, cost, ...) to justify corresponding development and industrialization costs**



Thank you for your attention